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TRANSACTIONS

OF THE

ILLUMINATING ENGINEERING SOCIETY

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32 VICTORIA STREET
LONDON SW1

NOTES ON RECENT MEETINGS AND EVENTS

General Meeting in London.

A joint meeting with the Institution of Engineers-in-Charge was held in the Lecture Theatre of the Institution of Mechanical Engineers (Westminster, S.W.1), on Tuesday, November 10. The chair was taken by the President at 7 p.m.

The minutes of the last meeting having been taken as read, the names of applicants for membership were presented in the usual way.

The President then called upon Mr. E. W. Murray to present his paper entitled "Factory Lighting and Accident Prevention."

An interesting discussion followed, in which the following took part:-- Mr. A. H. Foster (vice-president of the Institution of Engineers-in-Charge), Mr. C. C. Paterson, Mr. H. C. Weston, Mr. F. E. Shaw (chairman of the Technical Committee of the Institution of Engineers-in-Charge), Mr. R. O. Ackerley, Mr. A. W. Wyatt, Mr. Kenneth F. Sawyer, Mr. H. C. Cooper, Mr. J. G. Clark, Mr. F. Jackson, and Mr. J. S. Dow.

The President, in terminating the proceedings, proposed a cordial vote of thanks to the author, which was carried with acclamation.

Provincial Meetings.

It will be recalled that, as mentioned in the last issue of these Transactions, the opening meeting in Manchester on October 20 was devoted to an address reviewing progress in illumination presented by Mr. R. O. Ackerley. At a subsequent meeting in Manchester on November 24, an address on Architectural Lighting was delivered by Mr. R. O. Sutherland.

In Glasgow a similar opportunity of reviewing progress was presented at the meeting on November 3, when an address, "Milestones in Illumination," was delivered by the President (Mr. A. Cunnington). The address, like that of Mr. Ackerley in Manchester, referred to some of the chief discussions and events in the past history of the Society, and drew attention to recent technical developments, which were illustrated by exhibits of a similar character to those shown at the opening meeting in London. Mr. Alexander Lindsay presided.

In Dublin, on October 13, an address, "The Science of Seeing" was delivered by Mr. H. A. Lingard. In the subsequent discussion Mr. J. Warren Storey (Chief Electrical Engineer, Great Southern Railways), Mr. J. O'Farrell (Chief Engineer, Consumers Department, Electricity Supply Board), and Mr. E. N. Allam (Public Lighting Engineer, Dublin Corporation) took part. Mr. F. X. Algar presided.

Visit to Gatwick Airport.

On November 17 about seventy members and friends paid a visit to Gatwick Airport. On arrival, the party had an opportunity of viewing by daylight the layout of the aerodrome and of inspecting the landing ground, the hangars and the various floodlights. After tea had been taken, Mr. S. A. Gordon, the secretary and manager of the aerodrome, explained some of its leading features, and Mr. G. H. Wilson and Dr. W. M. Hampton gave brief technical accounts of the lighting. After the President had expressed thanks on behalf of the visitors, a selected group of members visited the control room (to which, owing to limitations of space, only a few could be admitted). An opportunity was subsequently provided for the party to study in darkness the effect of the lighting arrangements, an excellent final view of which was visible from the train as it departed.

Meeting of the Section on Photometry.

The first meeting of the session of this section took place at the Borough Polytechnic (London) on November 24, when an address, "Colorimetry and its Relation to Photometry," was delivered by Mr. J. Guild. The address, which was illustrated by numerous lantern slides and demonstrations, was heard with great interest, and a discussion ensued in which, amongst others, Mr. G. H. Wilson, Mr. R. Holmes, Mr. C. A. Morton, Mr. G. T. Winch, Mr. J. M. Waldram, Mr. F. E. Lamplough, and Mr. J. S. Dow took part. After Mr. J. Guild had replied to the discussion he was accorded a cordial vote of thanks on the motion of the Chairman, Mr. H. Buckley, who also expressed the thanks of the Society to Mr. Phillips, Mr. C. E. Greenslade and the Borough Polytechnic for the hospitality which the Society had enjoyed. Prior to the meeting members had an opportunity of inspecting the laboratories of the Department of Electrical Engineering.

Forthcoming Events.

Dec. 8th. Mr. Paul Freedman on **Low Voltage Neon.** *(General Meeting of the Illuminating Engineering Society, in the Lecture Theatre of the Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W.)*; **6.30 p.m.**

Dec. 17th. Mr. E. W. Murray on **Factory Lighting and Accident Prevention.*** *(Local Sectional Meeting of the Illuminating Engineering Society, at the Cadorna Restaurant, Glasgow).*

1937.

Jan 5th. Mrs. M. Pender-Chalmers on **Home Lighting.** *Local Sectional Meeting of the Illuminating Engineering Society, at the College of Technology, Manchester)*; **7.15 p.m.**

Jan. 12th. Mr. J. W. Howell on **Some Important Considerations in Colliery Lighting.** *(General Meeting of the Illuminating Society, in the Lecture Theatre of the Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W.1)*; **6.30 p.m.**

* *Repetition of paper read in London on Nov. 10.*

PROGRESS IN ILLUMINATION

Report prepared by the Technical Committee of the Illuminating Engineering Society: Mr. A. W. Beuttell (*Chairman*), Mr. H. Buckley, Mr. J. G. Clark, Mr. J. S. Dow, Dr. S. English, Mr. George Herbert, Mr. H. Lingard, Mr. Waldo Maitland, Mr. T. E. Ritchie, Mr. F. C. Smith, Mr. E. Stroud, Mr. G. H. Wilson. Co-opted: Mr. Harold Bright, Mr. W. J. Jones, Mr. A. R. McGibbon.

(Presented at the Opening Meeting on October 13th, 1936.)

This report is devoted mainly to progress in Great Britain during the year ended August 31, 1936. During this period interesting developments in some of the most notable advances of recent years have occurred, and progress in detail is again to be recorded.

Gas Lamps and Lighting Equipment.

Street Lighting. — Notable developments in gas lighting during the past year include new units for street lighting. These embody improved devices for the redirection of light, together with new designs of lamps to meet architectural needs.

Bollards.—Gas-lighted bollards have been further developed owing to the practically complete immunity from breakdown of the lighting system employed. An unlighted bollard during the dark hours is a source of danger instead of being a valuable safeguard, as it is when illuminated.

Interior Lighting.—New fittings of modern design have been developed for interior lighting.

Self-Lighting Burner.—Self-ignition of gas-lighting burners has been developed. Ignition of an air-gas mixture by means of a catalyst has been exploited many times in the past, but not with sufficient success to permit of its general use. Recently, however, the problem has been investigated afresh, particularly in connection with the operating conditions of the catalyst. The result has been the production of a catalyst which, when used under certain well-defined and controlled conditions, operates with great reliability. It has already been applied commercially to certain types of gas fire, and its application to the gas-lighting burner, for indoor and outdoor use, has been the subject of much experiment.

The catalyst consists of a small pellet of platinum black supported by four fine platinum wires across a rectangular framework of nickel steel wire about $\frac{3}{4}$ in. by $\frac{1}{2}$ in. When a mixture of air and gas in the right proportions is allowed to pass over this catalyst the temperature of the pellet of platinum black is raised by chemical action to a dull red heat and communicates heat to the platinum wires. These wires are in turn raised to a bright incandescent heat by further catalytic action, until their temperature is sufficient to ignite the gas. As the catalyst works satisfactorily only within a certain range of air-gas mixtures, and as it must be kept from contact with the products of combustion, it is necessary to mount the catalyst in a form of housing which insures the right conditions. It will be realised that the catalyst takes the place of the usual by-pass.

A further development in this connection employs a battery-heated catalyst which ignites a small jet of gas to form a temporary by-pass. After a few seconds both the by-pass and battery are turned off. The device operates automatically upon pressure of gas being applied to the burner.

Automatic Control. — Improvements have been made in devices for the automatic control of gas street lamps and other lamps.

Incandescent Tungsten Filament Lamps.

Coiled-Coil Filament Standard Lamps.—The tungsten filament lamp with a coiled-coil filament has now almost entirely superseded the single-coil lamp in the sizes in which it is made. Such lamps, which were previously only available in the 200-250 volt range, have been introduced in the 40-, 60-, 75-, and 100-watt sizes in the 100-130 volt range during the past year. The higher values of efficiency for coiled-coil lamps have been set out in the new issue of the "British Standard Specification No. 161," published in February last, which also records some increases in efficiency for other types of gas-filled lamps.

Architectural Lamps. — The applications of the architectural tubular lamp with the opal bulb introduced two years ago have been more fully developed, and improvements in durability and light-output have been made. A wide range of lengths and curves has been standardised. The production of these lamps in natural coloured opal glass has still further extended their uses.

This type of lamp is now being applied in many situations for which high-voltage, low-pressure electric discharge lamps were previously exclusively used. One striking point which has become apparent during the last year is the suitability of architectural lamps for use, unprotected, out-of-doors.

Projector Lamps for Home Cinemas.—A variety of new projector type lamps has been developed to meet the necessities of home cinematograph projectors. The features of these new lamps are:—

(a) The extremely small projected area of the filament and the elimination of distortion of the filament in use, both made possible by discoveries in the art of stabilisation of filaments by heat treatment.

(b) The small size of bulb now employed made possible by the use of heat-resisting glass, which enables the filament to be brought nearer to the lens or reflector, thus reducing the size of the apparatus and enabling a higher proportion of the available light to be utilised.

(c) The pre-focusing of the filament by the use of special caps with positioning flanges, which have the same relative position to the filament in all lamps of a given wattage.

Photographic Lamps.—The development of lamps to enable snapshots and moving pictures to be taken indoors, reported last year, has continued. Such lamps burning at efficiencies as high as 32 lumens per watt, with lives of two hours, are now part of the stock-in-trade of every photographic dealer, and are opening up a new field to the amateur photographer.

Vacuum Cleaner Lamps.—A minor but interesting development of the last year is the production of a small, very durable tubular lamp for use in conjunction with vacuum cleaners. The lamp is built into the body of the cleaner, so that the light is shown in front to help the busy housewife or domestic servant to make sure that the cleaning has been effective.

Lamps for Wireless Dials.—Special lamps have been called for by the designers of wireless receiving sets for illuminating the tuning dials. These are becoming almost universal on modern sets, doing away with the old difficulty of getting a sight of the tuning dial which was usually so situated in a room that it was badly lighted from external sources.

Cinema Studio Lamps.—Further improvements of design have become necessary in the high wattage (2 k.W. and over) lamps used in cinema film studios, the tendency being to improve the accuracy of construction so that the light from the lamps may be utilised more efficiently from the optical point of view and so reduce the wattage required for any particular picture and with it the heat which is and always has been objectionable since the introduction of talking films.

Electric Discharge Lamps.

The demand for this type of lamp continues to grow. Discharge lamps are finding extended use not not only for street lighting, but also for industrial lighting.

It is estimated that not less than 40,000 lighting points are to-day equipped with high pressure mercury lamps in Great Britain, rather more than half of these being utilised for street lighting.

During the past year, lamps of the high pressure mercury type have been introduced in the 150-watt size. The 150-watt lamp has an initial efficiency of 32 lumens per watt as compared with an efficiency of 13.45 lumens per watt for the 150-watt 230 volt tungsten filament lamp, while the 250-watt lamp has an initial efficiency of 36 lumens per watt.

Both the initial efficiency and the average efficiency throughout life of the discharge lamp is more than 100 per cent. better than that of the tungsten filament lamp.

The combined tungsten filament and mercury discharge lamp has also found increasing applications during the year in places where a more natural colour rendering is of importance.

Progress in connection with lamps of the super high-pressure type, shown in an experimental form at the opening meeting of the Society in October. 1935, has been made. One probable application of such lamps is for projection purposes.

Further developments in electric discharge lamps will undoubtedly be forthcoming both in the direction of smaller lamps operating at a higher pressure and in the form of lamps in which advantage is taken of the phenomena of fluorescence so as to transfer to the visible spectrum some of the energy radiated by the mercury vapour lamp outside the visible spectrum.

Special forms of electric discharge lamps designed for stroboscopic examination of machinery in motion, etc., have been developed. When subjected to an impulse of current a flash of light of exceedingly short duration, estimated at 10 micro-seconds, can be produced.

Electric Lighting Accessories and Equipment.

General Lighting.—Design in this field, apart from the more decorative forms of lighting units, has not included any very radical departures, but existing varieties have been modified and improved.

A new series of galleries for use with enclosed lighting units has been developed, a feature of the device being that it leaves both hands free to remove the lamp and globe and also renders the fitting dust-proof.

New types of units for use with incandescent lamps and 150-watt and 250-watt electric discharge lamps have been introduced. In one case a convenient interchange of reflectors of varying contour within a standard outer casing is possible. In view of the fact that the specular control of light is usually associated with silvered glass or polished metal reflectors, it is of interest to note the introduction of a vitreous enamelled reflector which, by full use of the specular component of reflection, produces a curve falling within the B.S.I. "wide distribution" class. To achieve this result with a reflector of moderate dimensions, two circular reflectors, one above the other, are used, the lower one coming into operation to control the light where the upper one terminates.

A novel type of industrial lighting unit, of an entirely indirect character, may be mentioned. This has proved particularly acceptable for the lighting of printing works.

A completely enclosed semi-indirect fitting, for 200 and 300-watt lamps, utilises inner refracting and reflecting glass prisms and smooth outer faces. The upper and lower glass members are secured by a simple internal fitting, which is held by a chromium-plated tube which carries the wiring. Various types of finish are available. When cut in half and suitably mounted, the fitting may serve as a wall bracket.

A new type of prismatic glass reflector for use in floodlights using standard lamps mounted in a vertical position has been developed. Prismatic lens fronts giving beams of various shapes have been prepared. The unit may be housed in an ornamental casing suitable for use on promenades and in gardens.

Other new types of prismatic glass units include improved bulkhead types with a smooth outer surface and a new pendant flame-proof fitting for 200-watt lamps containing an internal prismatic reflector and with a deep cut-off, which has received the Buxton certificate of the Ministry of Mines.

The development of plastic materials to serve as an alternative to decorative glass is being studied in this country. In the United States description of several types of material have appeared. One of these, produced from ureaformaldehyde, is said to possess certain advantages over glass.*

* M. B. Bigelow and A. M. Howald. Trans. Ill. Eng. Soc., U.S.A., Apr., 1936.

Hitherto, only surface marble has been available for decoration. Now by special selection and cutting of marbles to certain thicknesses one can obtain plates which, when illuminated from behind, reveal the structure and colour of the marble to a remarkable degree.

In the field of stage lighting one or two modifications in design have been reported. Experiments are being made with a spotlight of somewhat novel design which, it is believed, may supersede the ordinary variety equipped with small spherical mirror and plano-convex lens, the efficiency of which is somewhat low. Low voltage spotlights have been available for some time, but a development in the direction of lower working pressures may be noted. During the present year 12-volt lanterns, in three sizes up to 100-watt, have been introduced. Spotlights using remotely-operated colour screens have been more extensively applied, and some attention has been given to the design of floodlights with varied angles of dispersion. A new form of colour changer is being experimentally developed. This apparatus renders it possible to change slowly from one colour to another without having to pass through any set sequence, as is the case with a colour wheel.

Outdoor Lighting.—The design of lanterns to accommodate electric discharge lamps has not altered very materially except for changes involved in the use of lamps of lower wattage in the mercury type, and in the more extended use of sodium lamps. One fitting designed for the latter type of lamp comprises an opaque reflector with a relatively deep cut-off, but with a slot and translucent section which furnishes a moderately bright area and thus serves to avoid the somewhat subdued effect of complete screening of sources.

New types of vitreous enamelled reflectors for outdoor use have been developed. One variety may be mounted direct on the top of a pole without the usual swan-neck bracket. A design of more pleasing appearance is thus secured, and is likely to have special applications, for example, in connection with petrol service stations. A form of rectangular-shaped reflector for sign lighting likewise facilitates the elimination of the swan-neck. A special flange is provided which takes the supporting tube or bracket at the side.

The range of refractor dishes for street lighting with gas has been extended by the inclusion of types giving symmetrical light distributions as distinct from the symmetric distributions hitherto available. A special dish giving a symmetric distribution has been designed for use with the new type of gas lamp using mantles of rectangular shape.

A somewhat special form of unit for the underwater lighting of swimming baths has been devised. This utilises a horizontal burning line-filament. This is mounted in a fitting which, whilst still possessing sufficient carrying power to illuminate the centre of the bath, eliminates the unsightly dark patches between the portholes at the edge of the bath—which is apt to be an unsatisfactory feature of underwater systems employing symmetric, narrow beam floodlights.

Architectural Lighting.

Architectural lighting, in various forms, has been extensively developed during the past year. Luminous panels and fittings of unusual design, and built-in lighting equipment which forms an essential part of the decorative treatment of the interior, are now widely utilised.

Perhaps the most striking development has been the application of neon tubes and discharge lamps utilising fluorescent coatings for interior lighting. The variety of colour thus obtainable and the relatively high efficiency have led to the adoption of such systems in the form of visible systems of tubes (rings, rectangles, lines, etc.) which may be adapted to follow the contours of the decorative system. A novel feature is the triplication of tubes in three distinct colours, each separately controlled by a dimmer. The possibilities of indirect lighting with such systems are also being exploited. The fact that the dimensions of the tubes are small enables them to be mounted in a cornice of exceptionally small dimensions, and the relatively high efficiency now attained makes it possible to apply them effectively in the form of laylights and behind translucent wall panels of decorative design.

Industrial Lighting.

There appears to have been steady, if somewhat slow, progress in the field of industrial lighting during the past twelve months. However, there is a tendency for relatively high illuminations, of the order of 10 foot-candles, to be demanded for new installations, whilst even in the older factories the standard is being gradually raised. In his annual report for the year 1935, covering part of the period here reviewed, H.M. Chief Inspector of Factories remarks that improvement is specially noticeable in the lighting of factories situated in rural areas, owing to the advent of the grid system.

The use of low-voltage (12 volts) local lighting for work areas which are difficult to illuminate adequately by other methods has extended; but, in some cases, better results have been obtained by the use of specially designed trough fittings, in which a suitable number of medium wattage lamps are used. The latter method has been used in a large clothing factory for the lighting of sewing-machine benches and has proved very satisfactory.

Two interesting installations for indirect lighting deserve mention. In both factories concerned direct lighting was unsuitable, owing to glare experienced by reflection from the surface of metal objects inspected or handled by the workers. In one of these installations standard fittings were used, and in the other—used for the inspection of polished metal sheets—long trough fittings of special design were employed.

There has also been a marked increase in what has been termed " tailored illumination "—that is, the treatment of each installation according to the requirements of operators for specific processes, rather

than the provision of general illumination on a uniform plan. In particular, the special requirements in the case of such processes as the inspection of leather skins and the various operations in the chair and furniture making industries have been studied. The introduction of indirect lighting fittings specially designed for the needs of printing works, mentioned previously, might also be mentioned as an instance of an effort to meet special requirements by individual treatment.

The use of electric discharge lamps has increased, particularly in foundries and large engineering shops. The introduction of the 150-watt lamp has made it possible to light many premises where limited headroom had previously made it impracticable to use lamps of higher wattage, which were first developed. For certain operations, such as examination for defects in foundries, the detection of flaws in plate glass, and the picking of coal and ore, the colour of the light appears to be an advantage. For a number of processes, however, lamps in which the discharge lamp is combined with an incandescent (filament) lamp are finding preference.

A paper read by R. W. Daniel before the London branch of the Institute of British Foundrymen in the autumn of 1935 illustrated the need for improvement in the lighting of foundries where values under 2 foot-candles were found to be still quite usual.

An inquiry made by the Factory Department of the Home Office into the lighting of cotton weaving sheds shows that there is also room for improvement in this industry. Of eight sheds selected as samples, in which photometric measurements were taken, six were found to be provided with an average illumination of less than 2 foot-candles. In the case of thirty-eight firms, out of a total of fifty-eight whose weavers replied to a questionnaire, the artificial lighting was stated to be unsatisfactory.

An investigation into the lighting requirements for worsted weaving has been completed for the Illumination Research Committee of the Department for Scientific and Industrial Research, and the results, when published, should be of value in planning installations for cotton as well as worsted weaving.

Public Lighting

The Interim Report of the Ministry of Transport Departmental Committee on Street Lighting issued in October, 1935, gave a strong impetus to apply the essential principles of a useful installation. The man in the street has studied the "conclusions" which recommend for traffic routes a minimum standard of lighting "which enables drivers to proceed with safety at 30 miles per hour without the use of headlights." Lighting authorities and their engineers have been adopting the recommended technique. The recommendations to unify the administration of the lighting of traffic routes have also gained lay and professional attention.

A paper, dealing with the Report from a layman's point of view, was read at the 1936 Conference of the Association of Public Lighting Engineers; other papers discussed modern practice and problems in gas and electric street lighting.

Difficulties of present administration were treated in a paper by Mr. E. C. Lennox at the Public Works, Roads and Transport Congress. Such prominence is associated with the movement to provide fixed lighting in "arterial roads" outside of the "built-up areas" to which "street" lighting has been mostly confined.

There is more frequent reference to the British Standard Specification in contracts.

Discussion continues about the best road surface for grip, wear, and reflection. At the Annual Meeting of the Illuminating Engineering Society, Dr. Merry Cohu, of Paris, gave an account of his researches on road surfaces in relation to lighting.

New highways with two—and more—separate carriageways bring new problems in lay-out of installations. The 25 ft. mounting-height and 120-150 ft. spacing have been used in many schemes with large-power gas, electric filament and electric discharge lamps. On main thoroughfares new installations in place of old have been favoured; but side street lighting has also been improved, largely by raising the height at existing points and by changing burners or electric lamps to others of greater light-output. For all streets, with gas or electricity, directive reflectors and refractors are common practice.

The additional lighted miles have again been largely in new residential streets. There, the "short" pillar still prevails; but heights of 13-15 ft. are not so rare. The extension of town-boundaries has caused some increase of lighting.

In some towns and districts high-pressure gas lamps have increased in number, including the type with rectangular mantle and dish refractor. These are also features of a low-pressure lamp. Other low-pressure fashions are the use of globe or suspension lamps and of several mantles in alignment.

In electric lighting the mileage grows of discharge lamps: mercury type, and also sodium, not only on "traffic routes" but in shopping centres. In such cases a notable increase in illumination is almost invariably recorded.

Several papers have been read which brought up to their dates our information on the discharge lamp and also discussed street lighting. Chief amongst these was a paper read by G. H. Wilson, E. L. Damant and J. M. Waldram before the Institution of Electrical Engineers in which the conditions to be met by an optimum installation were specified.

At the Annual Conference of the Association of Public Lighting Engineers held in Cheltenham during September 7—10, 1936, a paper reviewing Street Lighting Practice in Holland was read by Professor G. B. v. d. Werfhorst. Others reviewed progress in gas and electric lighting and discussed the special problem of visibility of kerbs.

Progress has been helped by numerous, though slight, reductions in price of gas and electricity for public lighting. While there is still financial stringency, the tendency is to spend more on lighting, partly by increased consumption of illuminant, partly by purchase of new plant. Annual lighting-hours

per lamp tend to increase. More lamps have automatic control, gas by clocks, electric by time-switches, or forms of relay.

Luminous Traffic Control Signals.

Although there is little novel to record in connection with luminous traffic control signals there has been a substantial increase in their application during the past twelve months, in part due to the continued heavy toll of fatal accidents on the roads, and in part to the decision of the Minister of Transport to contribute 60 per cent. towards the cost of installation, which was the subject of reference in the last report. According to the records issued by the Ministry the total number of such signals was 38,336 in June, 1936, as compared with 32,148 in June, 1935. Of the various systems of control, that actuated by vehicular traffic, still seems to find most favour, especially for use on important crossings and junctions, though the "progressive" system is found useful in cases (as in Oxford Street, London) where the blocks are of unequal length. Installations in Trafalgar Square and Piccadilly, two of the most difficult spots in London to control, have now been completed, but other congested areas such as Elephant and Castle and Vauxhall Cross are still the subject of study. This also applies to a number of important sites in the City of London area. Mention may also be made of experiments with photo-electric methods of control, for example, in connection with crossings for pedestrians in South London.

Railway Lighting.

Lighting on the railways continues to progress on fairly orthodox lines, and there are no important novelties to report. Mention may, however, be made of a device which has been used on the Great Western line for improving the visibility of point levers in a large Marshalling Yard. These point levers are usually situated in positions where a lamp standard cannot be provided without becoming a source of danger. In order, therefore, to light the levers themselves a special lighting device, called the "Compass" light, has been installed at Old Oak Common Yard. The unit consists of a box, counter-sunk in the ground, at one end of which a low wattage lamp is provided. The bottom of the box is curved and painted white so that light is reflected upwards through the frosted plate glass lid. The "Compass" lights have been fixed in close proximity to point levers, which, in accordance with standard practice, are painted white, and, therefore, reflect sufficient light to enable them to be readily seen by the operatives.

The "Compass" lights have also been fitted with a numerically stencilled metal plate covering a portion of the plate glass lid. This gives a Shunter an exact idea of the location of the points, and it is from this point of the unit that its name is derived.

Stage and Pageant Lighting.

Whilst there have been no very radical departures in regard to method in this field, there have been several installations worthy of record. The Queen Mary is probably the first British ship to be equipped with a complete system of stage lighting, and with a stage suited to production on a scale similar to that in many London theatres. The installation was carried out on the four-colour system, and the switchboard is of unusual type, being so designed that the grand piano may be stored underneath it. Another installation of interest is that at the Television Studios, at the Alexandra Palace, London, for which two switchboards of special design were provided. Owing to their close proximity to the sound equipment special mercury switches were designed. The dimmer operating gear had likewise to be specially constructed in order to ensure silent operation.

In regard to pageants, floodlighting, as usual, formed an essential element at the Aldershot Tattoo. A feature of the Chamberlain Centenary Celebration at the Royal Albert Hall in July, was the illumination of a portrait measuring about 50 ft. by 25 ft. of the late Joseph Chamberlain, which was illuminated by six special lanterns with an average throw of 200 ft.

Exceptional arrangements have been made for the lighting of the immense Outdoor Tattoo Arena at the Empire Exhibition in Johannesburg. The whole of one side is provided with a gigantic cyclorama, 250 feet on either side of the stage, which, with its central pavilion, is reached by an enormous flight of steps. On the cyclorama cloud and wave effects are being produced by motor-driven apparatus, whilst the fore stage and flight of steps are illuminated from the other side of the arena by means of lanterns with a throw of 250 feet.

A somewhat unusual method of lighting was adopted for the spire of the central tower in the "City of Beautiful Night" at Olympia during the Ideal Home Exhibition. The tower was coated with fluorescent material, which was excited to vivid green fluorescence by ultra-violet radiation. Ordinary floodlighting, it was considered, would have spoiled the general night-sky effect.

Cinema Lighting.

Architectural lighting continues to play an important part in cinema theatres, the effects in some cases being highly elaborate. It is, however, still usual to show films in complete darkness. It has been urged that the contrast between the bright screen and the dark surround is liable to accentuate eyestrain, and to prejudice enjoyment of the display. Subdued general lighting, it has been suggested, might well be provided. In the meantime experiments with a white illuminated border to screens are being made. It is believed that this will serve a good purpose in diminishing eye-fatigue, forming a basis of comparison when colour films are being shown, and permitting a higher level of illumination in the auditorium without in any way prejudicing the appearance of the picture.

Floodlighting.

Floodlighting of local buildings was again in evidence during the period of various technical congresses, and preliminary arrangements in connection with the Coronation of King Edward in 1937 are already being made.

At seaside resorts it has been applied even more extensively than in recent years. The practice of

arranging special displays during civic weeks and similar local festivities is increasing. A notable instance was afforded during the past year by special lighting arranged in Chester. The floodlighting, by ornamental lanterns of the sunken gardens along the Rhyl promenade, has been the subject of comment. Seventy pedestal floodlights served the dual purpose of illuminating the parade and the gardens. Supplementary colour lighting for the flower beds was also provided. An interesting development in London has been the floodlighting by means of concealed neon tubes of the façade of the new Simpson store in Piccadilly. This is stated to be the first installation of its kind in this country.

In the industrial field the extended application of floodlighting in several large railway yards may be noted. The practice of floodlighting car parks in the vicinity of hotels, etc., is becoming quite a usual one.

Amongst installations abroad reference may be made to the experimental lighting of the Palace of Versailles in Paris, and the illumination of many historic buildings and remains in Athens on the occasion of the entry of the King of Greece.

Illuminated Signs.

Progress in illuminated signs has been confined largely to those using discharge tubes. By the use of luminescent powders applied to the inside walls of the tube, a large range of new colours, with, in some cases, considerably enhanced luminous efficiency, has been made possible.

These developments have led to the combination of tubes of different colours for interior lighting by which, in the language of one maker, it is possible to obtain any grade of light from grey dawn to sunset eve.

Until quite recently the mercury discharge was used exclusively for exciting these luminescent powders, and with certain powders increases in the luminous efficiency up to 800 per cent. have been attained. Recently, however, with certain powders and under suitable conditions, it has been found possible to excite luminescence by means of the neon discharge in the absence of mercury. The rich red light from the neon, combines with the luminescent radiation from the powder to produce a series of agreeable colours very suitable for interior lighting as well as for advertising.

A development which may fitly be recorded in this section, as it involves the use of light for purposes of publicity, is the display by night of "beacons" on the roofs of large factories and commercial buildings. A similar practice on the part of a restaurant in Vienna (which was not a suitable subject for floodlighting) has been noted.

Miscellaneous Installations.

A brief reference may be made to a few of the most striking installations brought before the notice of the Committee.

The lighting of the Queen Mary, for which decorative fittings were extensively used, has been fully illustrated and described. This is doubtless the most complete and elaborate lighting system ever installed in a sea-going vessel. The artificial lighting of the National Gallery and the Duveen extension of the National Portrait Gallery deserve mention because of the principle involved—that the public should be given opportunities to visit picture galleries during evening hours. The lighting of the Tir John Power Station at Swansea, where special methods were applied to each section of the building, is interesting as an example of the treatment of super-power stations. The illumination of the control room by means of an extensive artificial daylight, and the floodlighting of the coal dump and lime tanks outside the building, are typical of modern methods. Another instructive example of modern tendencies is to be found in the lighting of the Grimsby Fish Dock—stated to be the largest of its kind in the world—which formed the subject of a paper before one of the local sections of the Society.

In connection with decorative lighting, as previously reported, developments in neon tubular lamps, have had a striking influence. "Three colour neon" displays are being embodied in a number of decorative lighting schemes. One instance is furnished by the sun lounge at Bobby's Restaurant, Bournemouth, where a triple system of tubes, furnishing red and green and blue light, is concealed in the cornice surrounding the room.

Photometry and Instruments.

The developments in photometry which have taken place in the last twelve months have been mainly concerned with refinements in the existing methods of physical photometry. Visual photometry, however, still continues to receive attention, and Sewig (1), in a review of visual photometers, includes descriptions of a new polarisation photometer as well as the Gehlhoff-Schering telephotometer.

Further measurements on the colour temperature of flames have been made by Pearson and Pleasance (2), working with a Hefner lamp and a carefully controlled acetylene flame.

A summary of the seasonal variation of both daylight and sunlight illumination has been issued as Technical Paper No. 17 (3) by the Department of Scientific and Industrial Research. These measurements, which have extended over the last ten years, were made at Teddington, using a visual method.

On the subject of glare, Crawford (4) has shown that the effect of a number of glaring sources is additive.

The effect of selective absorption of the white paint used in photometric integrators has been investigated by Buckley (5). Using neon, sodium, and both low and high pressure mercury discharge tubes, the selective effect for these sources was found to be negligible for a considerable amount of selectivity.

The photo-electric cell still continues to find many applications in the field of commercial, as well as more accurate, photometry. Special attention has again been given to rectifier cells, and a number of papers on their performance have been published. Gouffé (6) gives an account of his work on the use of these cells for accurate photometry, and Marchal and Marton (7), while investigating the general properties, have made measurements of the linearity of

a cell and colour filter over a wide range of intensities. Barnard (8) has developed a method for compensating a selenium-sulphur cell for change of sensitivity, with change of the incidence of the light.

Photo-electric spectrophotometry has also been developed, and two papers (9), (10), describing the apparatus used in each case, have appeared. A photo-electric apparatus, by which the reflection factor of surfaces can be measured directly, has also been described (11.) Lallemand (12) has used a high precision micro-photometer for the photometry of non-uniformly illuminated fields; the arrangement of the apparatus was such that in all cases the cell was evenly illuminated.

The time-lag in the attainment of constant luminous output from tungsten filament electric lamps has been investigated by means of a photo-electric photometer by McDermott and Cuckow (13), and a method of colour-matching lamps, with the use of a single photo-cell and two colour filters, has been developed by Preston (14).

An account has been published by Jouaust (15) of the use of thermal (total radiation) photometers, with particular reference to heterochromatic photometry.

The British Standards Institution have recently published two Specifications dealing with portable photometers; the first, No. 230, 1935, deals with visual instruments, while the second, No. 667, 1936, deals with photo-electric instruments.

An interesting device has recently been developed by Zworykin (16) and called an " electron multiplier." Photoelectrons emitted in the normal way impinge on a suitably sensitised plate and give rise to a much increased number of secondary electrons. These are attracted to another plate at a higher potential and cause the emission of more secondary electrons. This process is repeated some six times and the amplification gained thereby is claimed to be in the region of one million.

(The Technical Committee desires to acknowledge assistance derived from the following:—Mr. L. G. Applebee, Mr. R. O. Ackerley, Mr. H. M. Cotterill, Mr. A. Cunnington, Mr. Cecil Hughes, Capt. W. J. Liberty, Mr. Howard Long, Mr. L. H. McDermott, Mr. E. J. Stewart, Mr. H. C. Weston, Mr. H. R. Ruff, Mr. J. M. Langdon.)

References.

(1) Sewig. Archiv für Technishes Messen, 5, p. 153, November, 1935.

(2) Pearson and Pleasance. Phys.Soc. Proc., 47, p. 1032, November, 1935

(3) D.S.I.R. Technical Paper No. 17, H.M. Stationery Office, 1935.

(4) Crawford. Phys. Soc. Proc., 48, p. 35, January, 1936.

(5) Buckley. Phil. Mag., 20, p. 745, November, 1935.

(6) Gouffé. R.G.E. 38, p. 355, September, 1935.

(7) Marchal and Marton. Rev. d' Opt., 15, p. 1, January, 1936.

(8) Barnard. Proc. Phys. Soc., 48, p. 153, January, 1936.

(9) Howlett. Canadian J. of Research, 14, A, p. 38, February, 1936.

(10) Broome and Thomas. El. Times, 89, p. 417, March, 1936.

(11) Anon. El. Times, 88, p. 308, September, 1935.

(12) Lallemand. Rev. d' Opt., 15, 3, p. 109, March, 1936.

(13) McDermott and Cuckow. J.S.I., p. 328, October, 1935.

(14) Preston. Proc. Phys. Soc., 47, p. 1012. November, 1935.

(15) Jouaust. R.G.E., 38, p. 419, September, 1935.

(16) Zworykin. Jour., I.E.E., Vol. 79, 475, p. 1, July, 1936.

APPLICATIONS FOR MEMBERSHIP

Elections Pending.

At the general meeting of the Society, held on November 10, the names of the following applicants for membership were presented:—

CORPORATE MEMBERS:—

Aldridge, J. F.	9, Barnsbury Park, LONDON, N.1.
Day, E. W. C.	51, Nathans Road, Wembley, MIDDLESEX.
Howell, J. W.	34, Woodlands Avenue, Worcester Park, SURREY.
Johnson, L.	22, Springbridge Road, Alexandra Park, MANCHESTER, 16.
Jones, J. Maitland	36, Duck's Hill Road, Northwood, MIDDLESEX.

COUNTRY MEMBERS:—

Bell, G.	130, Sunlight House, MANCHESTER.
Broadfoot, E.	15, Bertram Street, GLASGOW, S.1.
Dawson, J. P.	"Glenburn," Overtoun Road, Dalmuir, GLASGOW, W.
Freeman, G. F.	22, Cholomondeley Avenue, West Timperley, CHESHIRE.
Jenkins, H. B.	60, Waterloo Road, BEDFORD.
Martin, H. E. L.	196, Bath Street, GLASGOW, C.2.
Macleod, D. Macfarlane	7, Elmbank Street, GLASGOW, 2.
Oxford, C. G. H.	Dudley, Brownsea View Avenue, Parkstone, DORSET.
Somerset, J. A.	Bank Street, MANCHESTER, 15.

Elections Completed.

At this meeting the names of those announced on October 13, which were published in the issue of the Transactions (Vol. 1, No. 11, p. 158, November, 1936), were read again, and these applicants were formally declared members of the Society.

LIST OF EXHIBITS

On view at the Opening Meeting held at the E.L.M.A Lighting Service Bureau (2, Savoy Hill, London, W.C.2), on Tuesday, October 13th, 1936.

	SUBJECT OF DEMONSTRATION.	SPEAKER OR DEMONSTRATOR.
INTRODUCTION.		
1.	New Features at the Bureau: A New Advance in Electric Discharge Lamps.	Mr. W. J. JONES (*E.L.M.A. Lighting Service Bureau*).
SELECTED NOVELTIES.		
2.	Electric Discharge Lamps applied to Fluorescent Powders and for Stroboscopic Effects; Demonstration of Effect of High Pressures in Quartz Envelopes.	Mr. H. R. RUFF (*British Thomson-Houston Co., Ltd., Research Laboratory, Rugby*).
3.	Model Aerodrome illustrating British Requirements for the Lighting of Aerodromes for Night Flying.	Mr. G. H. WILSON (*Research Laboratories of the General Electric Co., Ltd., Wembley*).
4.	Applications of Luminescent Powders to Colour modifications of the High Pressure Mercury Discharge Lamp.	Mr. H. G. JENKINS (*Research Laboratories of General Electric Co., Ltd., Wembley*).
5.	The Production of Brightness Contours by the Photographic Method.	Mr. J. M. WALDRAM (*Research Laboratories of the General Electric Co., Ltd., Wembley*).
6.	(a) A Model Mirror Head for Photometric Work.	Mr. A. R. MCGIBBON (*Wm. Sugg and Co., Ltd.*).
	(b) An Automatic Emergency Gas Switch.	
7.	(a) A Burner Ignited by the "Cold" Catalytic Method.	Mr. K. F. SAWYER (*The Gas Light and Coke Company, Watson House*).
	(b) Improved Forms of Control for Public Lamps: Electro-Catalytic Gas Ignition.	Mr. J. BAKER (*The Horstmann Gear Co., Ltd.*).
8.	Electric Discharge Lamps, including a new 80-watt Quartz Mercury type, Super High Pressure Lamps operating at 80,000 candles per sq. cm., 1,000-watt type Burning in Air, New Lamps with Fluorescent Coating, etc.	Prof. Ir. G. B. VAN DE WERFHORST (*Holland*) and Mr. R. P. SAYERS (*Philips Lamps, Ltd.*).
9.	New Developments in Fluorescent Tubes.	Capt. C. HIGGINS (*Claude-General Neon Lights, Ltd.*).
DEVELOPMENTS IN ELECTRIC LAMPS.		
10.	150-watt Electric Discharge Lamps and New Types of Lanterns.	Mr. C. W. M. PHILLIPS (*The British Thomson-Houston Co., Ltd.*).
11.	Horizontal Discharge Lamps and New Horizontal Floodlight Fitting.	Mr. C. R. BICKNELL (*Siemens Electric Lamps and Supplies, Ltd.*).
STREET LIGHTING UNITS.		
12.	New Trough Fittings and Street Lighting Reflectors.	Mr. W. E. BUSH (*Curtis Lighting Company of Great Britain, Ltd.*).
13.	A New 400-watt Refractor Lantern for Mercury Lamps.	Mr. E. STROUD (*Holophane, Ltd.*).
14.	A New Fitting for Sodium Lamps.	Mr. G. J. WELLS (*Engineering and Lighting Equipment Co. Ltd.*).
15.	(a) New Forms of Exterior Lighting Lanterns.	Mr. A. G. BROWN (*The General Electric Co., Ltd.*).
16.	New Forms of Gas Lamps.	Mr. W. J. C. DAVEY (*The Parkinson Stove Co., Ltd.*).

PHOTOMETRY.

17.	New Photo-Electric Daylight Factor Meter. Apparatus used for Measuring the Light Centre Length of Pearl Lamps.	Mr. F. J. C. BROOKES (*National Physical Laboratory*).
18.	New Selective Filter for use with Photo-Electric Cells.	Mr. ROSS (*Weston Electrical Instrument Co., Ltd.*).
19.	An Experimental Visibility Meter.	Prof. Ir. G. B. VAN DE WERFHORST (*Holland*) and Mr. R. P. SAYERS (*Philips Lamps, Ltd.*).
20.	Colour Comparator for Testing Colour Glasses for Compliance with Aviation Colour Specifications.	Mr. C. A. MORTON (*Research Laboratories of the General Electric Co., Ltd., Wembley*).
21.	Apparatus for the Rapid Plotting of Polar Curves from a Photo-Cell Distribution Photometer (Experimental).	Mr. G. H. WILSON (*Research Laboratories of the General Electric Cc., Ltd., Wembley*).

MISCELLANEOUS FITTINGS, ETC.

22.	(a) Electric Discharge Glassteel Diffusers.	Mr. STUDHOLME (*Benjamin Electric, Ltd.*).
	(b) Wide Distribution Biflector.	Mr. LAVERY (*Benjamin Electric, Ltd.*).
	(c) Ile Reflector.	Mr. IMIRIE-SMITH (*Benjamin Electric, Ltd.*).
23.	A New Floodlight Unit and a New Type of Ceiling Unit.	Mr. E. STROUD (*Holophane, Ltd.*).
24.	A New Spotlight Lantern.	Mr. F. B. BENTHAM (*The Strand Electric and Engineering Co., Ltd.*).
25.	(a) Simplified Electric Discharge Low-wattage Floodlight. (b) Floodlight taking Horizontal Electric Discharge Lamps. (c) A New Gallery for use with Enclosed Units. (d) An Automatic Flameproof Unit for use at Coal Faces in Collieries.	Mr. S. ANDERSON (*General Electric Co Ltd.*).
26.	A New Design of Hospital Operating Theatre Fitting.	Mr. J. M. SANDFORD (*General Electric Co., Ltd.*).
27.	(a) Table Lamps. (b) Condenser Block for Dimming Lamps of various wattages.	Mr. HAROLD BRIGHT.
28.	Truvex Lenses for use in Lanterns and Film Projectors.	Dr. W. M. HAMPTON (*Chance Bros. and Co.*).
29.	New Hand Lamp operated by Vaporised Oil.	Mr. TURNER (*The Tilley Lamp Company*).
30.	A Model Stage for Theatre Lighting.	Mr. R. R. HOLMES.
31.	Decorative Di-Fractor Lanterns, and a New Lantern for Tungsten Filament Lamps.	Mr. J. G. CHRISTOPHER (*The General Electric Co., Ltd.*).
32.	Film Studio Lighting Unit. Also a Prismatic Lens and Special Lamp Holder.	Mr. BARRATT (*General Electric Co., Ltd.*).
33.	Photographs by Artificial Light.	Mr. R. G. HOPKINSON (*Research Laboratories of the General Electric Co., Ltd., Wembley*). (No Demonstration).
34.	The R.I.B.A. Indirect Lighting Fitting.	C. HARVEY AND CO. (No demonstration)

The Illuminating Engineering Society is not, as a body, responsible for the opinions expressed by individual authors or speakers.

With a view to avoiding possible confusion with other publications, reference to these Transactions should be in the form :—"Trans. Illum. Eng. Soc. (London)."

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